

Claims

[c1] We claim as our invention:

1. A golf club head comprising:

a body composed of a magnesium alloy material, the body comprising at least a portion of a sole and a portion of a crown of the golf club head; and

a plating deposited on the portion of the sole of the body, the plating comprising a nickel or nickel-based alloy material.

[c2] 2. The golf club head according to claim 1 wherein the plating has a thickness ranging from 0.0002 inch to 0.002 inch.

[c3] 3. The golf club head according to claim 1 wherein the nickel or nickel-based alloy material comprises a layer of MAGENTA electroless nickel and a layer of medium or high phosphorus electroless nickel.

[c4] 4. The golf club head according to claim 1 wherein the plating further comprises a zinc layer.

[c5] 5. The golf club head according to claim 1 wherein the plating further comprises a chromium layer.

- [c6] 6. The golf club head according to claim 1 wherein the plating further comprises a tin-cobalt layer.
- [c7] 7. The golf club head according to claim 1 wherein the plating further comprises a copper layer.
- [c8] 8. The golf club head according to claim 1 wherein the plating further comprises a zinc layer on the magnesium alloy material, a copper layer on the zinc layer, the nickel or nickel-based alloy on the copper layer, and a tin-cobalt or chromium layer on the nickel or nickel-based alloy layer.
- [c9] 9. The golf club head according to claim 1 wherein the plating has a Rockwell C hardness greater than 50.
- [c10] 10. The golf club head according to claim 1 further comprising a plating material on the crown portion of the body.
- [c11] 11. A golf club head comprising:
a face component composed of a metal material, the face component having a striking plate portion and a return portion, the striking plate portion having a thickness in the range of 0.010 inch to 0.250 inch and the return portion having a thickness ranging from 0.010 inch to 0.250 inch;
an aft-body composed of a metal material selected from

the group consisting of magnesium, magnesium alloys, aluminum, and aluminum alloys, the aft-body having a crown portion, a sole portion and a ribbon portion, the aft-body attached to the return portion of the face component; and
a plating layer disposed on the aft-body, the plating layer comprising nickel or nickel-based alloy material.

[c12] 12. The golf club head according to claim 11 wherein the plating layer has a thickness ranging from 0.0002 inch to 0.002 inch.

[c13] 13. The golf club head according to claim 11 wherein the plating layer comprises a layer of MAGENTA electroless nickel and a layer of medium or high phosphorus electroless nickel.

[c14] 14. The golf club head according to claim 11 wherein the plating layer further comprises a zinc layer on the metal aft-body, a copper layer on the zinc layer, the nickel or nickel-based alloy on the copper layer, and a tin-cobalt or chromium layer on the nickel or nickel-based alloy layer.

[c15] 15. The golf club head according to claim 11 wherein the aft-body is composed of an injection molded metal material.

- [c16] 16. The golf club head according to claim 11 wherein the golf club head has a volume ranging from 290 cubic centimeters to 600 cubic centimeters.
- [c17] 17. The golf club head according to claim 11 wherein the moment of inertia about the Izz axis of the golf club head is greater than 3000 g-cm^2 .
- [c18] 18. The golf club head according to claim 11 wherein the face component is composed of a metal material selected from the group consisting of titanium alloy, amorphous metal, stainless steel and maraging steel.
- [c19] 19. The golf club head according to claim 11 wherein the nickel or nickel-based alloy is deposited by an electrolytic process.
- [c20] 20. The golf club head according to claim 11 wherein the nickel or nickel-based alloy is deposited by an electroless process.
- [c21] 21. A golf club head comprising:
a face component composed of a metal material, the face component having a striking plate portion and a return portion, the striking plate portion having a thickness in the range of 0.010 inch to 0.250 inch and the return portion having a thickness ranging from 0.010 inch

to 0.250 inch, the return portion extending a distance ranging 0.25 inch to 1.5 inches;
an aft-body comprising an upper section and a lower section, the upper section comprising a crown portion and an upper ribbon portion and the lower section comprising a sole portion and a lower ribbon portion, the aft-body composed of a metal material selected from the group consisting of magnesium, magnesium alloys, aluminum, and aluminum alloys, the aft-body attached to the return portion of the face component, the aft-body having a thickness ranging from 0.015 inch to 0.100 inch; and
a plating layer disposed on the aft-body, the plating layer comprising nickel or a nickel-based alloy material, the plating layer having a thickness ranging from 0.0002 inch to 0.002 inch.

- [c22] 22. A golf club head comprising:
a body composed of a magnesium alloy material, the body comprising at least a portion of a sole and a portion of a crown of the golf club head; and
a plating deposited on the portion of the sole of the body, the plating comprising an electroless nickel layer and a layer of one of a medium phosphorus nickel-based alloy material or a high phosphorus nickel-based alloy material.

- [c23] 23. The golf club head according to claim 22 further comprising a striking plate coupled to the body, the striking plate being composed of a material selected from the group consisting of titanium, titanium alloys, amorphous metals, and stainless steel.
- [c24] 24. The golf club head according to claim 22 wherein the plating further comprises a chromium layer.
- [c25] 25. A method for producing a nickel-plated magnesium component for a golf club head, the method comprising: de-ionizing a component for a golf club head, the component composed of magnesium or a magnesium alloy material; and electroless plating the component with a nickel or nickel-based alloy material to create a nickel-plated component having a plating layer with a thickness ranging from 0.0002 inch to 0.002 inch.
- [c26] 26. The method according to claim 25 wherein electroless plating the component includes electroless plating the component first with a MAGENTA and then with a medium or high phosphorus nickel or a high phosphorus nickel.
- [c27] 27. The method according to claim 25 further comprising applying a plasma vapor deposition coating to the

nickel-plated component.

- [c28] 28. The method according to claim 27 wherein the plasma vapor deposition coating comprises a titanium nitride or a titanium aluminum carbide.
- [c29] 29. The method according to claim 25 further comprising applying a chemical vapor deposition coating to the nickel-plated component.
- [c30] 30. The method according to claim 25 further comprising treating the component with ammonium fluoride to inhibit oxidation of the magnesium.
- [c31] 31. The method according to claim 25 further comprising applying a zinc layer prior to electroless plating.
- [c32] 32. The method according to claim 31 further comprising applying a copper layer to the zinc layer prior to electroless plating.
- [c33] 33. The method according to claim 32 further comprising applying a tin-cobalt layer subsequent to electroless plating.
- [c34] 34. The method according to claim 32 further comprising applying a chromium layer subsequent to electroless plating.

- [c35] 35. The method according to claim 25 wherein the component of the golf club head is a sole section.
- [c36] 36. The method according to claim 25 wherein the component of the golf club head is an aft-body.
- [c37] 37. A golf club head comprising:
a first part composed of a first material and having a mass ranging from 50 grams to 110 grams;
a second part attached to the first part, the second part composed of a second material selected from the group consisting of magnesium, magnesium alloy, aluminum, and aluminum alloy, the second part having a mass ranging from 10 grams to 60 grams; and
a plating layer on at least a portion of the second part, the plating layer having a mass ranging from 0.5 grams to 5 grams,
wherein the golf club head has a mass ranging from 150 grams to 300 grams.
- [c38] 38. The golf club head according to claim 37 wherein the golf club head has a volume ranging from 350 cubic centimeters to 465 cubic centimeters.
- [c39] 39. The golf club head according to claim 37 wherein the golf club head has a moment of inertia, I_{zz} , about the Z-axis of the center of gravity ranging from 2800 g-cm² to

5000 g-cm².

- [c40] 40. The golf club head according to claim 37 wherein the first part is a face component including a striking plate portion and a return portion, and wherein the second part is connected to the return portion of the first part.
- [c41] 41. The golf club head according to claim 37 wherein the first part is composed of a titanium alloy material.